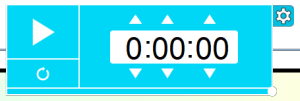
(c) specific latent heat of fusion and specific latent heat of vaporisation; $E = mL$

(d) (i) an electrical experiment to determine the specific latent heat of fusion and vaporisation

(ii) techniques and procedures used for an electrical method to determine the specific latent heat of a solid and a liquid.

(6) M - Define the terms: specific latent heat of fusion and specific latent heat of vaporisation
(7) S - Select and apply the equation for specific latent heat
(8) C - Describe an electrical experiment to determine the specific latent heat of fusion and vaporisation

Specific latent heat



STARTER:
Peer mark the HWK.
Use the **practical guidance booklet** for more information.
WWW/EBI SR in response

	Expected Answers	Mark	Additional Guidance
A1.1	Sets up the experiment safely and correctly without help. ✓ Determines the temperature of the water and 100 g mass without help. ✓	2	Any help given should be recorded on the front cover of the task sheet. Any help given should be recorded on the front cover of the task sheet.
A1.2	Calculates a value for E correctly. ✓ Repeats the experiment for one further value of starting temperature. ✓	2	Penalise power of 10 error / inconsistent unit. Any help given should be recorded on the front cover of the task sheet. θ_M must be in the range 60 °C to 70 °C
A1.3	Identifies one hazard **and** describes appropriate safety precaution. ✓	1	e.g. avoid splashing as the mass is inserted **and** so put in beaker slowly, or breaking the beaker **and** so put in beaker slowly/ carefully. Do not allow 'use goggles' / 'use lab coats' / 'tie hair back' / 'string' / '(oven) gloves'.
B1.1	Records **all** data required in a suitable table. ✓ Correctly determines both values for s.h.c. ✓	2	The table must include the following quantities: θ_M, θ_2, $(\theta_M - \theta_2)$, $(\theta_2 - \theta_1)$, E. Ignore units, sig. fig. and d.p. One value should be centre value ±50%
B1.2	Discusses with appropriate justification the value of the s.h.c. of the metal block. Supports the observations by sound reasoning in terms of the energy losses. ✓✓✓	3	Credit the following marking points and ignore reference to one of the s.h.c. values being greater/smaller than the other. The s.h.c. values are different because the 100 g mass: 1. loses more energy when transferred from the higher temperature hot water; 2. also warms up the beaker/container (and the cold water); 3. may not have reached temperature θ_M/thermal equilibrium. 4. Allow one other detailed correct statement that supports the observations. Do not allow loses energy (to surroundings) when transferred from hot water to cold water.
	Total	**10**	

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(6) M - Define the terms: specific latent heat of fusion and specific latent heat of vaporisation
(7) S - Select and apply the equation for specific latent heat
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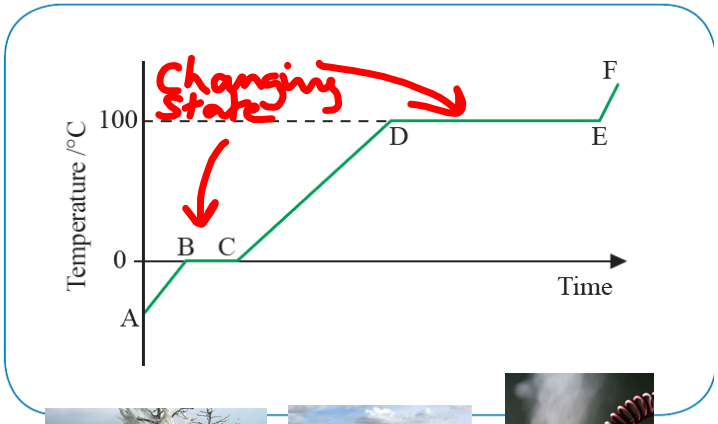
Specific latent heat

Key point

Specific latent heat, L is defined as the energy requires to change the phase per unit mass - while at constant temperature.

$$L = \frac{E}{m}$$

J/kg J kg



Key point

When a substance changes from a solid to a liquid it is called: **Specific latent heat of fusion**

When a substance changes from a liquid to a gas it is called: **Specific latent heat of vaporisation**

(6) M - Define the terms: specific latent heat of fusion and specific latent heat of vaporisation
(7) S - Select and apply the equation for specific latent heat
(8) C - Describe an electrical experiment to determine the specific latent heat of fusion and vaporisation

0:00:00

Activity: Complete summary Q1-6

Q4 / Q6

Kilo 10^3	
Mega 10^6	Start at 3
Giga 10^9	Start at 5

Key point

An old principle saves energy

(6) M - Define the terms: specific latent heat of fusion and specific latent heat of vaporisation
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0:00:00

Mini: plenary:

1. What is the definition for specific latent heat of fusion....?
2. The SLH of F for water is 3.3×10^5 Jkg^{-1} A 25g ice cube is left on a desk. The flow of heat energy to the ice is equivalent to 5W. How long until the ice cube melts?

Kilo 10^3

Mega 10^6

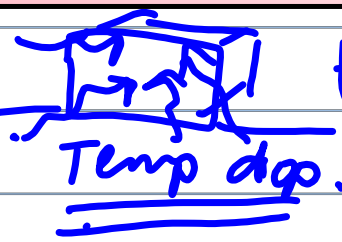
Giga 10^9

$E = mL = 0.025 \times 3.3 \times 10^5$
$= 8250\,J.$

Why is this time likely to be inaccurate?

$E = Pt =$

Key point



Temp drop.

$t = \frac{E}{P} = \frac{8250}{5} = 1650\,s.$

(6) M - Define the terms: specific latent heat of fusion and specific latent heat of vaporisation
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Measuring specific latent heat - demonstration

1. For both demonstrations, complete the method write up sheet.
2. Find and describe a more accurate method to measure the mass of evaporated water for practical 2.
3. Find similarities between the methods and highlighting certain parts of your text.

Kilo 10^3
Mega 10^6
Giga 10^9

Why is this time likely to be inaccurate?


Key point

Specific latent heat of fusion	Specific latent heat of vaporisation
Labelled diagram of setup	Labelled diagram of setup
Method – basic procedure (the measurements)	Method – basic procedure (the measurements)
Equations and calculations	Equations and calculations
Uncertainties and solutions	Uncertainties and solutions

1.2×10^6 6.02×10^6

Substance	Specific latent heat of fusion (L_f) (J/kg)	Melting point (°C)	Specific latent heat of vaporization (L_v) (J/kg)	Boiling point (°C)
aluminum	6.6×10^5	2519	4.0×10^5	10 900
ethyl alcohol	1.1×10^5	−114	8.6×10^5	78.3
carbon dioxide	1.8×10^5	−78	5.7×10^5	−57
gold	1.1×10^5	2856	6.4×10^4	1 645
lead	2.5×10^4	327.5	8.7×10^5	1 750
water	3.4×10^5	0	2.3×10^6	100

% difference

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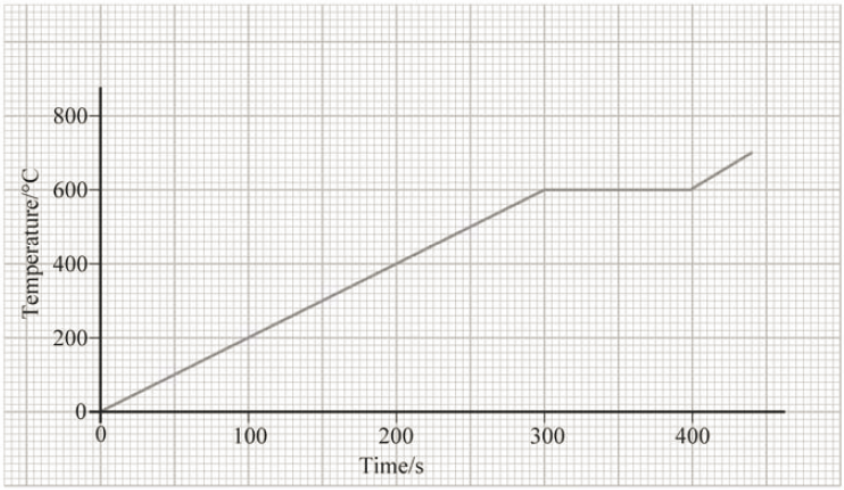
Plenary

The diagram below shows the variation of the temperature of 200 g of lead as it is heated at a steady rate.



a Use the graph to state the melting point of lead. [1]

b Explain why the graph is a straight line at the start. [1]

c Explain what happens to the energy supplied to the lead as it melts at a constant temperature. [1]

d The initial temperature of the lead is 0 °C. Use the graph to determine the total energy supplied to the lead before it starts to melts. [3]
(The specific heat capacity of lead is 130 J kg^{-1} K^{-1}.)

e Use your answer to **d** to determine the rate of heating of the lead. [2]

Kilo 10^3

Mega 10^6

Giga 10^9

Calculate the specific latent heat of fusion of lead.

(6) M - Define the terms: specific latent heat of fusion and specific latent heat of vaporisation
(7) S - Select and apply the equation for specific latent heat
(8) C - Describe an electrical experiment to determine the specific latent heat of fusion and vaporisation

Plenary - MS

a Melting point = 600 °C [1]
(There is no change in temperature during change of state.)

b The lead is being heated at a steady rate and therefore the temperature also increases at a steady rate. [1]

c The energy supplied to the lead is used to break the atomic bonds and increase the separation between the atoms of lead (and hence their potential energy increases). [1]

d $E = mc\Delta\theta$ [1]
$E = 200 \times 10^{-3} \times 130 \times (600 - 0)$ [1]
$E = 1.56 \times 10^4$ J $\approx 1.6 \times 10^4$ J [1]

e In a time of 300 s, 1.56×10^4 J of energy is supplied to the lead.
Rate of heating = power

$$\text{power} = \frac{1.56 \times 10^4}{300}$$ [1]

power = 52 W [1]

next lesson - melting ice cube to find SLH.

combining SHC and SLH